REMARKS

Upon entry of the present amendment, claims 36 and 37 will have been amended, and claims 20-37 will be pending. In view of the herein contained amendments and remarks, Applicants respectfully request reconsideration and withdrawal of the outstanding rejections and allowance of the pending application.

In the Office Action of March 18, 2005, the Examiner rejected claims 28, 29, 34, 36, and 37 under 35 U.S.C. § 102(b) as being anticipated by POWELL, II et al. (U.S. Patent No. 6,130,920). This rejection is respectfully traversed for the following reasons.

Pending claim 34 recites, *inter alia*, "estimating a first synchronization timing of the received signal based on a vector operation result;

obtaining, from an operation value ratio table that stores operation value ratios and a plurality of associated short times, the operation value ratios indicating ratios between a plurality of correlations determined at sampling timings shifted from ideal sampling timings by the short times, and detecting an operation value ratio closest to a ratio between the correlations corresponding to the first synchronization timing; and

detecting a timing shifted from the first synchronization timing by a short time corresponding to the detected operation value ratio as a second synchronization timing." Pending claim 28 recites similar terms, including "an operation value ratio table that stores operation value ratios and a plurality of associated short times, said operation value ratios indicating ratios between a plurality of correlations determined at sampling timings shifted from ideal sampling timings by the short time."

Accordingly, present claims 28 and 34 recite estimating a synchronization timing in two steps. That is, present claims 28 and 34 recite first estimating a synchronization timing based on a vector operation result (low accuracy), thereafter detecting an operation value ratio closest to a ratio between the correlations corresponding to the (low accuracy) synchronization timing from an operation value ratio table, and then determining a timing shifted from the (low accuracy) first synchronization timing by a short time corresponding to the detected operation value ratios as a second (high accuracy) synchronization timing.

For each of claims 28 and 34, the "operation value ratio" refers to the ratio between the correlations of a pair of neighboring sample timings. The operation ratio table associates an operation value ratio with a short time, where one of the two neighboring sample timings corresponding to the operation value ratio is shifted from an ideal synchronization timing by the short time, as recited in claims 28 and 34.

By contrast with at least the above-noted features of claims 28 and 34, POWELL, II et al's. MAX INDEX simply refers to the index of the correlator where the correlation is maximum, and bears no relationship to the operation value ratio table of the present invention.

POWELL, II et al. only discloses selecting a maximum output among a plurality of correlation outputs in accordance with MAX INDEX and determining the best sampling instance. According to POWELL, II et al., this best sampling instance refers to the timing when the correlation between a received signal and a known signal is maximum. According to POWELL, II et al., the accuracy in synchronization timing determination does not improve in time order of shorter time. POWELL, II et al. only teaches determining the best sampling instance in time order of the sampling interval.

Thus, POWELL, II et al. does not disclose an operation value ratio that is associated with a short time, such is recited in detail in each of claims 28 and 34.

For these reasons, Applicants respectfully submit that the rejection of claims 28 and 34 is improper.

Pending claim 36 recites, *inter alia*, (as amended), " an operator that determines a correlation at each sample timing through a vector operation using a sampling result of said receiver and a known signal sequence;

a first estimator that estimates a sample timing corresponding to a largest correlation of the determined correlations as a low-accuracy synchronization timing of the received signal;

an operation value ratio table that associates an operation value ratio with a short time, said operation value ratio indicating a ratio between two correlations corresponding to a pair of neighboring sample timings including a sample timing shifted from an ideal synchronization timing by the short time, said short time being shorter than a sample interval of the predetermined sampling intervals; and

a second estimator that reads said operation value ratio table and detects an operation value ratio closest to a ratio between correlations corresponding to the low-accuracy synchronization timing and a sample timing next to the low-accuracy synchronization timing, and estimates a timing shifted from the low-accuracy synchronization timing by a short time corresponding to the detected operation value ratio as a high-accuracy synchronization timing."

Claim 37 recites, *inter alia*, (as amended), "estimating a sample timing corresponding to a largest correlation of the determined correlations as a low-accuracy synchronization timing of a received signal;

reading an operation value ratio table that associates an operation value ratio with a short time, said operation value ratio indicating a ratio between two correlations corresponding to a pair of neighboring sample timings including a sample timing shifted from an ideal synchronization timing by the short time, said short time being shorter than a sample interval of the predetermined sampling intervals;

detecting an operation value ratio closest to a ratio between correlations corresponding to the low-accuracy synchronization timing and a sample timing next to the low-accuracy synchronization timing; and

estimating a timing shifted from the low-accuracy synchronization timing by a short time corresponding to the detected ,operation value ratio as a high-accuracy synchronization timing."

Similar to claims 28 and 34 above, by contrast with at least the above-noted features of claims 36 and 37, POWELL, II et al. (U.S. Patent No. 6,130,920) POWELL, II et al's. MAX INDEX simply refers to the index of the correlator where the correlation is maximum, and bears no relationship to the operation value ratio table of the present invention. For the same reasons given above with respect to claims 28 and 34, POWELL, II et al. does not disclose an operation value ratio that is associated with a short time, such is recited in detail in each of claims 36 and 37 .

In addition, a feature of each of claims 36 and 37 is to make a short time corresponding to an operation value ratio shorter than the signal sampling interval. This

feature of claims 36 and 37 makes it possible to determine a synchronization timing on the order of a time shorter than the sampling interval.

More specifically, with respect to claims 36 and 37, first, where there are a plurality of sample timings, the sample timing having the greatest correlation value is estimated as a low accuracy synchronization timing. This low accuracy synchronization timing is estimated in time order of the sampling interval. After this, an operation value ratio corresponding to the low accuracy synchronization timing is detected from a plurality of operation value ratios associated with respective short times shorter than the sampling interval, and the low accuracy synchronization timing is shifted by the short time the operation value ratio is associated with, thereby estimating a high accuracy synchronization timing. By this means, the present invention as recited in claims 36 and 37 makes it possible to estimate an accurate synchronization timing on the order of a shorter time than the sampling interval, or with accuracy higher than the resolution of the oversampling in the reception (see pp. 36-41 of the disclosure).

However, with respect to each of claims 36 and 37, POWELL, II et al. does not teach associating an operation value ratio with a short time shorter than the sampling interval. Without disclosing the operation value ratio, POWELL, II et al. cannot estimate a high accuracy synchronization timing on the order of a shorter time than the sampling interval.

For these reasons, and for the same reasons stated above with respect to claims 28 and 34, Applicants respectfully submit that the rejection of claims 36 and 37 is also improper.

Thus, Applicant respectfully submits that POWELL, II et al. does not disclose the above-noted feature of claims 28, 34, 36 and 37 of estimating a (high accuracy) synchronization timing from a (low accuracy) synchronization timing and an operation value ratio, and, with respect to claims 36 and 37, of associating an operation value ratio with a short time shorter than the sampling interval.

Dependent claim 29 is also submitted to be in condition for allowance at least in view of its dependence on claim 28.

For these reasons, Applicants respectfully submit that the rejection of claims 28, 29, 34, 36, and 37 under 35 U.S.C. § 102(b) as being anticipated by POWELL, II et al. is improper, and request withdrawal of the rejection.

In the Office Action of March 18, 2005, the Examiner rejected claim 30, which is dependent upon claim 28, under 35 U.S.C. § 103(a) as being unpatentable over POWELL, II et al. in view of YAMAMOTO (U.S. Patent 5,369,668) and further in view of SHIMIZU (U.S. Patent No. 5,886,668). Dependent 30 is also submitted to be in condition for allowance at least in view of its dependence on claim 28.

In the Office Action of March 18, 2005, the Examiner rejected claim 33 under 35 U.S.C. § 102(b) as being anticipated by SNYDER et al. (U.S. Patent No. 5,563,596). This rejection is respectfully traversed for the following reasons.

First, Applicants submit that rejected claim 33 is a method claim having recitations substantially similar to many of the recitations of allowed (apparatus) claim 20. For this reason, Applicant respectfully requests that the Examiner consider claim 33 allowable for the same reasons that claim 20 is allowable.

In addition, and in particular, pending claim 33 recites, *inter alia*, " shifting a phase of the sampling timing by 180° at a time interval longer than a symbol duration;

estimating a second synchronization timing of the received signal at a sampling timing phase shifted from the sampling timing of the first synchronization timing by 180°; and

estimating a third synchronization timing, which is a definitive synchronization timing of the receiving signal, from the first synchronization timing and the second synchronization timing," e.g., shifting the phase of a sample timing by 180° per predetermined time that is longer than the symbol length and determining a synchronization timing, and then estimating a definitive synchronization timing using the estimated synchronization timing.

By contrast with the above-noted recitations of claim 33, SNYDER et al. (U.S. Patent No. 5,563,596) discloses shifting the phase of a received signal. In SNYDER et al., both A/D converter 18 and A/D converter 30 perform sampling at a rate indicated by clock signals 22 and 22'.

Applicants respectfully submit that shifting the phase of a received signal is not the same as shifting the phase of a sample timing by 180°. Unlike the recitations of claim 33, SNYDER et al. does not disclose that the sampling timings of these clock signals 22 and 22' differ by 180°.

For these reasons, Applicants respectfully submit that the rejection of claim 33 under 35 U.S.C. § 102(b) as being anticipated by SNYDER et al. is improper, and request withdrawal of the rejection.

In the Office Action of March 18, 2005, the Examiner rejected claims 31, 32, and 35 under 35 U.S.C. § 103(a) as being unpatentable over YAMAMOTO (U.S. Patent 5,369,668) in view of SHIMIZU (U.S. Patent No. 5,886,668).

Pending claim 35 recites, *inter alia*, " canceling inter symbol interference from the received signal using tap coefficients in a tap coefficient table which stores tap coefficients and a plurality of associated short times, the tap coefficients corresponding to sampling timings shifted from ideal sampling timings by the short times," and "estimating a timing shifted from the predetermined sampling timing by a short time corresponding to the detected tap coefficient as a synchronization timing of the received signal. Pending claim 31 recites similar terms, including " a canceler that cancels inter symbol interference from the received signal using the tap coefficients in said tap coefficient table," and "an estimator that detects a tap coefficient that yields a maximum operation result in said operator and estimates a timing shifted from the predetermined sampling timing by a short time corresponding to the detected tap coefficient as a synchronization timing of the received signal."

Accordingly, each of pending claims 31 and 35 recites features that include, e.g., canceling intersymbol interference from a received signal (sampled at a predetermined sample timing using a plurality of tap coefficients, as recited in detail); and determining a timing shifted from the predetermined sample timing by a short time (corresponding to the tap coefficients of a best intersymbol interference cancellation result, as recited in detail).

By contrast with the above-noted features of pending claims 31 and 35, YAMAMOTO discloses updating tap coefficients of a transversal filter through a correlation operation.

However, as can be determined from YAMAMOTO's FIG. 1, the synchronization timing in QAM modulator 2 and A/D converter 3 is not determined using an output of transversal filter 4. In addition, the portion of the YAMAMOTO disclosure relied upon by the Examiner, *i.e.*, column 3, lines 6-10, only discloses updating tap coefficients of a correlator using an output signal of an out-of-sync-detector 11. YAMAMOTO does not disclose using an output of transversal filter 4 with updated tap coefficients in determining a synchronization timing.

Accordingly, YAMAMOTO does not disclose determining a synchronization timing from an intersymbol interference cancellation result, and therefore fails to disclose canceling intersymbol interference from a received signal (sampled at a predetermined sample timing using a plurality of tap coefficients, as recited in further detail in claims 31 and 35), or determining a timing shifted from the predetermined sample timing by a short time (corresponding to the tap coefficients of a best intersymbol interference cancellation result, as recited in further detail in claims 31 and 35).

SHIMIZU discloses storing a plurality of tap coefficients. SHIMIZU also does not disclose or suggest canceling intersymbol interference from a received signal (sampled at a predetermined sample timing using a plurality of tap coefficients, as recited in further detail in claims 31 and 35), or determining a timing shifted from the predetermined sample timing by a short time (corresponding to the tap coefficients of a best intersymbol interference cancellation result, as recited in further detail in claims 31 and 35).

Accordingly, neither YAMAMOTO nor SHIMIZU discloses the above-noted features of pending claims 31 and 35. To the extent that the Examiner has not identified all of the elements of claim 31 or claim 35 in either YAMAMOTO or SHIMIZU, either taken alone or

together, Applicants respectfully submit that the Examiner has not made out a *prima facie* case of obviousness. Further, Applicant submits that, lacking all of the elements of the claims, the Examiner also cannot have provided adequate motivation or suggestion to combine the same, nor have assessed the likelihood of success of such combination.

For these reasons, Applicants respectfully submit that the rejection of claims 31 and 35 under 35 U.S.C. § 103(a) as being unpatentable over YAMAMOTO in view of SHIMIZU is improper, and request withdrawal of the rejection. Dependent claim 32 is also submitted to be in condition for allowance at least in view of its dependence on claim 31.

Based on the above, it is respectfully submitted that this application is now in condition for allowance, and a Notice of Allowance is respectfully requested.
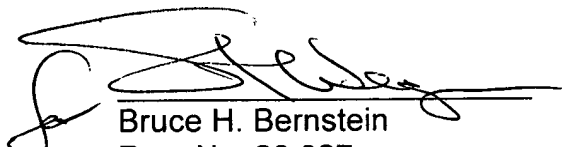
SUMMARY AND CONCLUSION

Entry and consideration of the present amendment, reconsideration of the outstanding Office Action, and allowance of the present application and all of the claims therein are respectfully requested and now believed to be appropriate. Applicants have made a sincere effort to place the present invention in condition for allowance and believe that they have now done so.

Any amendments to the claims which have been made in this amendment, and which have not been specifically noted to overcome a rejection based upon the prior art, should be considered to have been made for a purpose unrelated to patentability, and no estoppel should be deemed to attach thereto.

Should the Examiner have any questions or comments regarding this response, or the present application, the Examiner is invited to contact the undersigned at the below-listed telephone number.

Respectfully submitted,
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June 15, 2005
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